

REMARKS/ARGUMENTS

Claim 1 has been amended to indicate that the microstructure control agent is selected from the group consisting of cyclic ethers, aliphatic monoethers, aliphatic polyethers, tertiary amine compounds, and mixtures thereof. Support for this amendment may be found in paragraph [0011] of the application as filed. In addition, claims 16 to 19 have been added. Claims 16 to 19 are directed to specific aliphatic monoethers, specific cyclic ethers, specific aliphatic polyethers and specific tertiary amine compounds, respectively. No new matter has been added. The species of claims 16 to 19 are found in paragraph [0011] of the application as filed.

The Examiner has rejected Claims 1 to 15 under 35 U.S.C. § 103(a) as being unpatentable over Jones, U.S. Patent Re. No. 27,145 (hereinafter "Jones") or Graafland et al, U.S. Patent No. 5,795,944 (hereinafter "Graafland et al") in view of Bening et al, U.S. Patent Publication No. 2003/0176582 A1 (hereinafter "Bening et al"). This rejection is respectfully traversed with regard to claims 1 to 15, as amended, and newly added claims 16 to 19.

Claims 1 to 15, as amended, and newly added claims 16 to 19 are patentable over Jones since Jones fails to teach or suggest a process for preparing a hydrogenated conjugated diene block copolymers which includes a step requiring the titration of the admixture of solvent, microstructure control agent, and alkenyl aromatic monomer using an anionic polymerization initiator in order to purify the admixture prior to initiating the polymerization with a charge of the desired quantity of anionic polymerization initiator.

Jones provides a process for preparing hydrogenated block copolymers by block polymerizing a vinyl arene with butadiene in the presence of a polar compound to cause a limited amount of branching in the polybutadiene block. Column 2, line 57 to column 3, line 1, of Jones provides:

[A] means has been devised for the preparation of such branched block copolymers which comprises the steps of utilizing an alkyl lithium catalyst in a relatively inert hydrocarbon solvent for the block copolymer at each stage of its

formation modified with a critically defined proportion of a polar compound of the group consisting of ethers, thio-ethers and tertiary amines; forming a first polymer block of an alkenyl aromatic hydrocarbon in said medium to form a living polymer block; adding butadiene thereto and continuing polymerization until the desired weight has been obtained; thereafter introducing an alkenyl arene and continuing block copolymerization to finally obtain the A-B-A block copolymer wherein the center polybutadiene block has the recited degree of branched configuration.

Jones indicates that the polar compound is used to modify the alkyl lithium catalyst/hydrocarbon solvent medium and that the first polymer block of alkenyl aromatic hydrocarbon is formed in this medium. There is no suggestion that the mixture should be put together in any particular manner.

Furthermore, column 4, lines 51 to 62, of Jones provides:

[T]he basic process when using the lithium-based catalysts comprises forming a solution of the first alkenyl arene monomer in an inert hydrocarbon such as alkanes, alkenes or cycloalkanes modified by the presence of the polar compounds of the group consisting of ether, thio-ethers and tertiary amines. Of course, since the presence of the polar compound is not essential in the formation of the first polymer block with many initiators, it is not essential to introduce the polar compounds at this stage since it may be introduced just prior to or together with addition of the butadiene for the formation of middle elastomeric branch block.

While it is true that Jones indicates that the polar compound can be added in the first step of the process, once again, there is no indication that the initiator should be added to the other ingredients in a particular manner. In fact, there is nothing within Jones which teaches or suggests that it is essential to titrate the admixture of solvent, microstructure control agent, and alkenyl aromatic monomer by adding the initiator in small amounts until the mixture is purified (this titration serves to "react away impurities" (see, page 6, line 10 of the present application as filed)) and then adding sufficient amount of initiator

to support the polymerization process. Absent such a teaching or suggestion, it cannot be said that process of the present invention is obvious in view of Jones.

Applicant proposes that one of ordinary skill in the art, reading Jones would assume that the manner of adding the components was not crucial to the invention of Jones. However, Applicant maintains that one of ordinary skill in the art, adding the polar compound in the first stage of the process with the initiator would find themselves with a different product from that achieved if they had added the polar compound just prior to or together with the addition of the butadiene. The difference in products is due to the reaction of the initiator with impurities that are often found in polar compounds (such as water). The resulting reaction of the initiator with the impurities of the polar compounds would lead to what is commonly referred to as styrene die out. Such a reaction would occur very quickly and would result in a product that is different from that of the product produced in the present process in which the initiator is titrated in to allow for a controlled polymerization. In addition, in the process of the present invention, one would simply have to add the conjugated diene monomer after allowing sufficient time for the living polymer to react with and incorporate the alkenyl aromatic monomer thereby providing a one reactor process.

Accordingly, in the absence of some teaching or suggestion in Jones that it is necessary to titrate the admixture to the degree taught in the present invention, it cannot be said that Jones renders claims 1 to 15, as amended, and newly added claims 16 to 19 of the present application unpatentable. Applicant therefore requests that the rejection of claims 1 to 15, as amended, and newly added claims 16 to 19 under 35 U.S.C. § 103(a) as being unpatentable over Jones be respectfully withdrawn in view of the above arguments.

The Examiner further rejected claims 1 to 15 under 37 C.F.R. § 103(a) as being unpatentable over Graafland et al in view of Bening et al. This rejection is respectfully traversed with regard to claims 1 to 15, as amended, and newly added claims 16 to 19.

The claims of the present application are patentable over Graafland et al in view of Bening et al since nothing in Graafland et al, considered alone or in combination with Bening et al, teaches or suggests a process for preparing a hydrogenated conjugated diene block copolymer which includes a titrating step in which an anionic polymerization initiator is used to purify an admixture of solvent, alkenyl aromatic monomer and microstructure control agent.

Graafland et al disclose a process for the polymerization of dienes which comprises anionically polymerizing dienes in the presence of an anionic polymerization initiator and a microstructure control agent wherein the process is improved by adding the control agent to the polymerization mixture in two or more doses to closely control the vinyl content of the polymer produced. The Graafland et al patent is directed to microstructure control agents that are temperature sensitive and appears to deal almost exclusively with heavy ethers which include "1,2-diethoxy-ethane, 1,2-diethoxy-propane, orthodimethoxybenzene, 1,2-di-n-butoxy-ethane, 1-t-butoxy-2-n-butoxy-ethane, n-C₄H₉OCH₂CH₂O-n-C₄H₉, n-C₄H₉OCH₂CH₂OCH₂OCH₃, n-C₄H₉OCH₂CH₂O-t-C₄H₉, n-C₄H₉OCH₂CH₂OCHCH₃-O-i-C₄H₉. See, column 4, lines 40 to 47. While Graafland et al do indicate that the process can include other microstructure control agents (see specifically column 4, lines 37 to 38 where it is stated that the microstructure control agents include the aforementioned compounds and heavy ethers), the only other mention of the microstructure control agents is in the background of the invention where it is noted that in the prior art microstructure control agents have included ether compounds and tertiary amines which compounds include cyclic ethers such as tetrahydrofuran, tetrahydropyran and 1,4-dioxane; aliphatic monoethers such as diethyl ether and dibutyl ether; aliphatic polyethers such as ethylene glycol dibutyl ether, diethylene glycol diethyl ether and diethylene glycol dibutyl ether; aromatic ethers such as diphenyl ether and anisole; tertiary amine compounds such as triethyl amine, tripropyl amine, tributyl amine; and other compounds such as N,N,N',N'-tetramethylethylene diamine, N,N-diethyl aniline, pyridine and quinoline. While Graafland et al at first glance appear to be stating that these microstructure control agents would function in the process disclosed therein by Graafland et al, they then go on to indicate that within the prior art, there have been lots of problems associated with diethyl ether, an aliphatic monoether. In column 4, lines

47 to 51, Graafland et al indicate that the heavy ethers "are stronger and can be used in smaller amounts than the presently used diethyl ether and thus, do not require recovery, storage, and treatment facilities, making the overall process less expensive to operate." Accordingly, based on the statements of Graafland et al, it can be said that Graafland et al teach against at least the use of aliphatic monoethers such as diethyl ether in the process of Graafland et al. In view of the above, Applicant maintains that at least those claims specifically directed to aliphatic monoethers are patentable over Graafland et al. Bening et al, when considered with Graafland et al, does not add anything to the teachings of Graafland et al which would lead one of ordinary skill in the art to the presently claimed invention. Bening et al, although using diethyl ether and titration in building the midblocks of the Bening et al block copolymer, only use the diethyl ether in the second reactor of a two step/two reactor process. Step I of the process, which forms the styrene endblock of the copolymer, is carried out in a different reactor in the absence of diethyl ether. One of ordinary skill in the art, reading Graafland et al in view of Bening et al would not be lead to modify the process of Graafland et al to achieve the presently claimed process.

In addition, Applicant maintains that the present process is still patentable when using microstructure control agents besides aliphatic monoethers. More specifically, the present process is patentable when using cyclic ethers, aliphatic monoethers, aliphatic polyethers, tertiary amine compounds, and mixtures thereof.

As noted previously, the process of Graafland et al centers around the fact that many microstructure control agents are temperature sensitive. More specifically, Graafland et al indicate that "as the temperature goes up, they become less effective and the vinyl content in the polymer produced goes down." See column 4, lines 60 to 62. Graafland et al go on to indicate that:

For reproducibility and control in the polymerization process it is easier to start up the process and run the process wherein the startup portion of the process is carried out adiabatically and the rest of the process is carried out isothermally. Thus, the microstructure control agent is added to the polymerization mix during

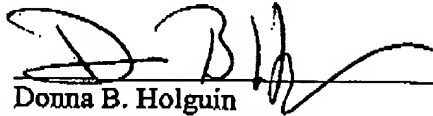
the startup or adiabatic portion of the process to maintain constant microstructure during that time.

With reference to this section, it is clear that the microstructure control agent is added prior to the isothermic stage. Accordingly, the process of Graafland et al is divided into two stages: the adiabatic stage and the isothermic stage. However, as clearly set forth in the examples, this does not necessarily mean that the adiabatic stage consists of only one step. As seen in Table 1 of the examples, the initiator and styrene are added together in step I of the process and allowed to react for 30 minutes. In step II, the polymerization was carried out in a cyclohexane/isopentane mixture and part of the butadiene was added batch-wise and the titration of the solvent was carried out by heat detection. The microstructure control agent was added after completion of the titration. As can be seen in Table 2, the microstructure control agent was also added in step II. Therefore, there is nothing in Graafland et al which teaches or suggests a step in which an admixture of solvent, microstructure control agent and alkenyl aromatic monomer is titrated using an anionic polymerization initiator to react away impurities prior to initiating the polymerization reaction. As noted above, Bening et al do not add anything to the teachings of Graafland et al which would lead one of ordinary skill in the art to the presently claimed invention. Bening et al is relied upon by the Examiner for the use of methanol as a termination agent and the use of a coupling agent. Therefore, it cannot be said that Graafland et al, whether considered alone or in combination with Bening et al, renders claims 1 to 15, as amended, and newly added claims 16 to 19 unpatentable under 37 C.F.R. § 103(a). Accordingly, Applicant requests that the rejection of claims 1 to 15, as amended, and newly added claims 16 to 19 be withdrawn.

In view of the above, Applicant maintains that the claims of the present application are patentable over the prior art cited by the Examiner and respectfully request allowance of said claims.

Respectfully submitted,

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